



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 398 404 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 158(3) EPC

(43) Date of publication:

17.03.2004 Bulletin 2004/12

(51) Int Cl.7: **D04B 7/30, D04B 1/22**

(21) Application number: **02722882.4**

(86) International application number:
PCT/JP2002/004298

(22) Date of filing: **26.04.2002**

(87) International publication number:
WO 2002/097179 (05.12.2002 Gazette 2002/49)

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **25.05.2001 JP 2001157985**

(71) Applicant: **Shima Seiki Mfg., Ltd**
Wakayama-shi, Wakayama 641-8511 (JP)

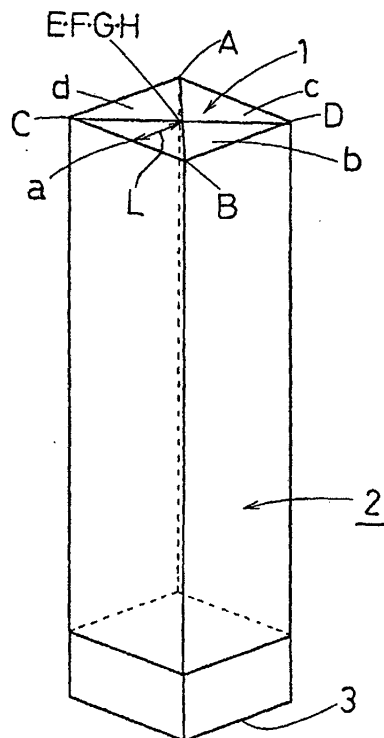
(72) Inventor: **OKAMOTO, Kazuyoshi**
Wakayama-shi, Wakayama 641-8511 (JP)

(74) Representative: **White, Duncan Rohan et al**
Edward Evans Barker
Clifford's Inn
Fetter Lane
London EC4A 1BZ (GB)

(54) **CYLINDRICAL KNITTING FABRIC BOUND WITH DEPTH FORMED AND METHOD OF KNITTING IT**

(57) The stitches of front and back knitted fabrics are overlapped with each other and bound off in the regions located on both the outermost right and left sides in a knitting width at the terminal end of the tubular knitted fabric in which the front and back knitted fabrics are continuous to each other as well as the stitches of the adjacent regions in the front and back knitted fabrics, in which the stitches of the front and back knitted fabrics are overlapped with each other and bound off between the regions, are overlapped with each other and bound off.

Fig.5



EP 1 398 404 A1

Description

Technical Field

[0001] The present invention relates to a tubular knitted fabric in which front and back knitted fabrics are continuously joined to each other at both the ends thereof by a flat knitting machine and in which a depth is formed and joined between the front and back knitted fabrics at the terminal end of the knitted fabric and to a method of knitting the tubular knitted fabric.

Background Art

[0002] A knitted fabric, in which one end of a tubular knitted fabric is joined as shown in FIG. 8 is knitted, the knitted fabric is formed as a tubular knitted fabric whose front and back knitted fabrics are continuously joined to each other at both the ends thereof, the stitches of the final courses of the front and back knitted fabrics, which are held to needle beds that confront in back and forth, at the terminal ends thereof are laid on any one of the needle beds so as to form new stitches thereat, and the new stitches are bound off from one end to the other thereof, thereby the tubular knitted fabric whose one end is joined can be knitted.

[0003] However, in the tubular knitted fabric whose one end is joined by the above method, since the front and back knitted fabrics are simply bound off by overlapping the loops of the confronting final courses thereof, the loops of the final courses of the front and back knitted fabrics are only overlapped with each other and no depth is formed to the final end portion of the joined knitted fabric.

[0004] An object of the present invention is to provide a tubular knitted fabric in which a depth is formed and joined thereto on the side thereof where knitting is ended and a method of knitting the tubular knitted fabric.

Disclosure of the Invention

[0005] To achieve the above object, a tubular knitted fabric of the present invention having a depth formed thereto and joined that is knitted by a flat knitting machine having at least a pair of front and back needle beds each slidably accommodating knitting needles is characterized in that the stitches of front and back knitted fabrics are overlapped with each other and bound off in the regions located on both the outermost right and left sides in a knitting width at the terminal end of the tubular knitted fabric in which the front and back knitted fabrics are continuous to each other as well as the stitches of the adjacent regions in the front and back knitted fabrics, in which the stitches of the front and back knitted fabrics are overlapped with each other and bound off between the regions, are overlapped with each other and bound off.

[0006] Next, a method of knitting a tubular knitted fab-

ric of the present invention by closing the terminal end of a knitted fabric knitted as the tubular knitted fabric in which a front knitted fabric is continuous to a back knitted fabric at both the ends thereof by a flat knitting machine having at least a pair of front and back needle beds each slidably accommodating knitting needles is characterized by comprising a step of dividing the loops of the final course of a tubular knitted fabric held to front and back needle beds into a plurality of regions, overlapping the stitches of front and back knitted fabric that confront in front and back in the regions located on the right and left outmost sides of the divided regions with each other and binding off the overlapped stitches, and a step of overlapping the stitches of the adjacent regions in the front and back knitted fabrics in the opening region located between the regions on the outermost right and left sides, which are bound off at the above step, each other and binding off the overlapped stitches.

[0007] Further, one characteristic of the present invention resides in that the step of overlapping the stitches of the front and back knitted fabrics with each other and binding off the overlapped stitches comprises a step of repeating knitting for transferring the stitches of the front knitted fabric nearest to the side end thereof from a front needle bed to a back needle bed at one end of the tubular knitted fabric in the knitting width thereof and transferring the stitches of the back knitted fabric nearest to the side end thereof from the back needle bed to the front needle bed at the other end of the tubular knitted fabric so that the respective regions to be joined of the knitted fabrics are shifted to the positions of the front and back needle beds at which the respective regions confront each other, thereafter overlapping the stitches held to the knitting needles of the needle beds that confront each other in front and back, and binding off the overlapped stitches.

[0008] Further, another characteristic of the present invention resides in that a knitted portion is formed by flechage knitting by reversing a yarn feed direction in mid course of the knitted region of the tubular knitted fabric and using the knitting needles of a part of the knitted region subsequent to knitting of a tubular shape, and the loops of the final courses of the flechage-knitted portion are coupled with each other.

Brief Description of the Drawings

[0009]

FIGS. 1(a) to 1(e) are views explaining knitting processes of a tubular knitted fabric according to an example 1;

FIGS. 2(a) to 2(c) are plan views of knitted fabrics in the knitting process of the tubular knitted fabric according to the example 1;

FIGS. 3(a) and 3(b) are perspective views of the knitted fabrics in the knitting process of the tubular knitted fabric according to the example 1;

FIGS. 4(a) to 4(d) are views explaining a modified example of the coupling of stitches in the knitting process of the tubular knitted fabric according to the example 1;

FIG. 5 is a perspective view of the tubular knitted fabric according to the example 1;

FIG. 6 is a perspective view of the tubular knitted fabric according to the example 1 when it is used;

FIGS. 7(a) to 7(h) are views explaining knitting processes of a tubular knitted fabric according to an example 2;

FIG. 8 is a perspective view of the tubular knitted fabric according to the example 2; and

FIG. 9 is a perspective view of a tubular knitted fabric according to a conventional example.

Best Mode for Carrying Out the Invention

[0010] An embodiment of a tubular knitted fabric in which a depth is formed and a knitting method of the tubular knitted fabric according to the present invention will be explained below based on the drawings.

[0011] First, a knitting machine used in the present invention is a flat knitting machine having at least a pair of front and back needle beds each accommodating knitting needles such that they can slidingly advance and retract with the front and back needle beds are needle plated so as to relatively move right and left.

[Example 1]

[0012] FIGS. 1(a) to 1(e) and FIGS. 3(a) to 3(b) show an example when a tubular cover 2 having a bottom 1 is formed as an example of a tubular knitted fabric having a depth formed thereto and joined as shown in FIG. 5, and FIG. 1(a) shows the terminal end portion of the tubular knitted fabric shown in FIG. 5. In FIG. 1(a), reference numeral I (thick line portion) and reference numeral II show knitted fabric portions held to the knitting needles of the front needle bed or to the knitting needles of the back needle bed, respectively.

[0013] Then, these front and back knitted fabrics I and II are coupled with each other at both right and left end portions C and D, and isosceles-triangular knitted fabrics a, b, c, and d are formed to the front and back knitted fabrics I and II to form a bottom as shown in FIG. 3(a).

[0014] Of these isosceles-triangular knitted fabrics a, b, c, d for forming the bottom, the knitted fabrics a and b are formed of isosceles-triangle by a flechage knitting using knitted fabrics C - B and B - D held to the knitting needles of the front needle bed as bases, and the knitted fabrics d and c are formed of isosceles-triangles by a flechage knitting using knitted fabrics C - A and A - D held to the knitting needles of the back needle bed as bases, respectively. The number of stitches h1 to the apexes E, F, G, H of these isosceles-triangles are one half the number of stitches between confronting sides of a rectangle shown in FIG. 5, that is, they are same as

the number of stitches to the center to a tube.

[0015] Next, the outside oblique surface portions of the respective isosceles-triangles that confront each other in front and back (CE and CG, and DF and DH) are overlapped with each other and bound off from the outside stitches to the inside stitches as shown in FIG. 1(b) using the binding-off method previously invented by the applicant and disclosed in Japanese Patent No. 3044368.

[0016] With the above operation, a state shown in FIG. 3(b) and FIG. 1(c) is obtained, and the bound-off portions are removed from the knitting needles. It is needless to say that the binding-off method is by no means limited to the method disclosed in the above patent publication.

[0017] Thereafter, the knitted fabrics held to the knitting needles of the front and back needle beds are shifted from a state shown in FIG. 1(c) to a state shown in FIG. 1(d) and FIG. 2(c). This shift is executed by, for example, sequentially shifting the stitches of the front needle bed to the back needle bed from the right end thereof at the right end of the tubular knitted fabric while moving the back needle bed left, and, in parallel with the above shift, by sequentially shifting the stitches of the back needle bed to the front needle bed from the left end thereof at the left end of the tubular knitted fabric while moving the back needle bed left.

[0018] The knitted fabrics shifted to the state of FIG. 1(d) and 2(c) are in a state as if they are turned. Next, when oblique surface portions (AE and AF, and BG and BH) are overlapped with each other and bound off from the outside stitches to the inside stitches using the binding-off method invented by the applicant and disclosed in Japanese Patent No. 3044368 as shown in FIG. 1(e) similarly to the above-mentioned, a tubular cover 2, which has a bottom 1 in which a depth is formed, is formed as shown in FIG. 5.

[0019] Reference numeral 5 in FIG. 6 denotes a window formed on a side wall portion of the tubular cover 2.

[0020] Note that although the knitted fabrics held to the knitting needles of the front and back needle beds are shifted from the state of FIG. 1(c) to the state of FIG. 1(d) and FIG. 2(c), oblique surface portions may be coupled with each other as shown in FIG. 4(d), in place of the above shift.

[0021] A method of coupling the oblique surface portions with each other as shown in FIG. 4(a) to 4(d) is such that steps executed in FIGS. 4(a) to 4(c) are the same as the step executed in FIG. 1(d) of the above embodiment, and, in a step executed in FIG. 4(d), the adjacent stitches of the stitches of the oblique surface portions (AE and AF, and BG and BH) held to the knitting needles of the front and back needle beds are coupled with each other by the method proposed by the applicant previously and disclosed in W001/88243.

[0022] In the method disclosed in W001/88243, the stitches between B and H of the front knitted fabric are transferred from a state shown in FIG. 4(c) to the empty

needles on the back needle bed as well as the stitches between E and A of the back knitted fabric are transferred to the empty knitting needles on the front needle bed. Then, stitches are newly formed by sequentially overlapping the stitches, which have been shifted onto the back needle bed, of the knitted fabric BH with the stitches at the right end between B and G of the above knitted fabric on the front needle bed from the stitches of the knitted fabric BH at the left end thereof while moving the back needle bed as well as loops are newly formed by overlapping the loops between A and E of the back knitted fabric with the stitches at the left end between A and F of the back knitted fabric on the back needle bed from the loop at the right end between A and E of the back knitted fabric. When the above knitting is repeated, the BG and BH portions of the front knitted fabric and the AE and AF portions of the back knitted fabric are bound off such that the stitches near to points A and B are overlapped with each other and the stitches far from the points A and B are overlapped with each other. According to the method disclosed in WO01/88243, yarn cut due to the wear of yarns can be prevented because stitch transfer of the same loop need not be repeatedly executed between the front and back needle beds to execute the binding-off. However, when only a small number of loops are required, the binding-off method is by no means limited to the method disclosed in WO01/88243, and any method may be employed as long as it can join the BG and BH portions of the front knitted fabric to each other and the AE and AF portions of the back knitted fabric to each other such that the stitches near to each other and the stitches far from each other are overlapped with each other, respectively with respect to the points A and B.

[0023] A bottle 4 such as a wine bottle or the like is inserted into the tubular cover 2 formed as described above from an article charging port 3 formed of a knitting start portion as shown in FIG. 6, the bottle 4 is accommodated in the tubular cover 1 while fitted to the bottom 1 thereof to which the depth is formed.

[Example 2]

[0024] This example employs a hexagonal bottom 1 as shown by α in FIG. 8 in place of the bottom 1 in the above example. When the hexagonal bottom shown in FIG. 8 is formed, each three front and back isosceles-triangular knitted fabrics a, b, c, d, e, f having apexes G, B, H, E, A, F are formed to front and back knitted fabrics I and II coupled with each other at both ends C and D by flechage knitting in a state shown in FIG. 7(a).

[0025] The number of stitches h1 to the apexes G, B, H, E, A, F is the same as the number of stitches to the center of a tube in the state α in FIG. 8.

[0026] Next, the outside oblique surface portions of the respective isosceles-triangles that confront each other in front and back (CE and CG, and DF and DH) are overlapped with each other and bound off as shown

in FIG. 7(b) using the binding-off method previously invented by the applicant and disclosed in Japanese Patent No. 3044368, and the stitches of these portions are removed from the knitting needles (refer to FIG. 7(c)).

[0027] Thereafter, the knitted fabrics I and II held to the knitting needles of the front and back needle beds are shifted from a state shown in FIG. 7(c) to a state shown in FIG. 7(d) by sequentially shifting the stitches of the front needle bed to the back needle bed from the right end thereof at the right end of a tubular knitted fabric while moving the back needle bed left, and, in parallel with the above shift, by sequentially shifting the stitches of the back needle bed to the front needle bed from the left end thereof at the left end of the tubular knitted fabric as described in the above example 1. As a result, the knitted fabrics shifted to the state of FIG. 7(d) are in a state as if they are turned.

[0028] Then, the outside oblique surface portions of the respective isosceles-triangles that confront each other in front and back (IA and IE, and LB and LH) are overlapped with each other again and bound off as shown in FIG. 7(e), and the stitches of these portions are removed from the knitting needles (refer to FIG. 7(f)).

[0029] Further, the stitches of the front needle bed are sequentially transferred to the back needle bed from the end thereof while moving the back needle bed so that the knitted fabrics are shifted to the state shown in FIG. 7(g), and then the oblique surface portions (JA and JH, and KH and KA) are overlapped with each other and bound off from the outside stitches to the inside stitches thereof as shown in FIG. 7(h) by the same binding-off method as that described above. As a result, a tubular cover 2 having a hexagonal bottom 1 as shown by α of FIG. 8 is formed.

[0030] As described above, according to the knitting method of the embodiments, in the terminal end portion of the tubular knitted fabric, after the loop of the front knitted fabric is overlapped with the loop of the back knitted fabric and bound off in the regions located on both the outermost right and left sides, the stitches of the front knitted fabric and the stitches of the back knitted fabric in the adjacent regions in the region located between the region in which the stitches of the front and back knitted fabrics are overlapped with each other and bound off, thereby the terminal end portion of the tubular knitted fabric can be joined through the depth formed thereto.

[0031] Note that although the above embodiments describe the case that the binding-off is executed after the triangular flechage knitted portions are formed in the terminal end portion, the present invention is not limited to form the triangular portions by the flechage knitting described above. Although it is possible to form the bottom portion flat by forming the triangular portions, the object for providing the depth can be achieved without forming the triangular portions.

[0032] When stretch yarns are used when the bind-

ing-off is executed, a joined portion can be made inconspicuous because the knitted fabrics are attracted to each other at the joined portion.

[0033] Further, when the bottom portion is divided into six portions or more, after the knitted fabrics are turned laterally as shown in and after FIG. 7(c), a knitting operation is repeated as many times as the number of the portions to be divided to execute the binding-off.

[0034] In addition to the above-mentioned, although the knitted portion in the terminal end portion of the tubular knitted fabric is formed of the isosceles-triangles, it is also possible to form the terminal end portion of scalene triangles, and the tubular knitted fabric according to the present invention is not limited to accommodate an article, and it is needless to say that it can be embodied to form a knit product such as a hat.

Industrial Applicability

[0035] As described above, according to the present invention, when a tubular knitted fabric, which has front and back knitted fabrics continuous to each other at both the ends thereof, is knitted by a flat knitting machine having at least a pair of front and back needle beds each slidably accommodating knitting needles, the stitches of the front and back knitted fabrics are overlapped with each other and bound off at both the right and left ends thereof in a width direction in the terminal end portion of the tubular knitted fabric as well as the stitches of the front knitted fabric and the stitches of the back knitted fabric in the adjacent regions in the region located between the region in which the stitches of the front and back knitted fabrics are overlapped with each other and bound off, thereby the tubular knitted fabric having the depth formed thereto can be formed.

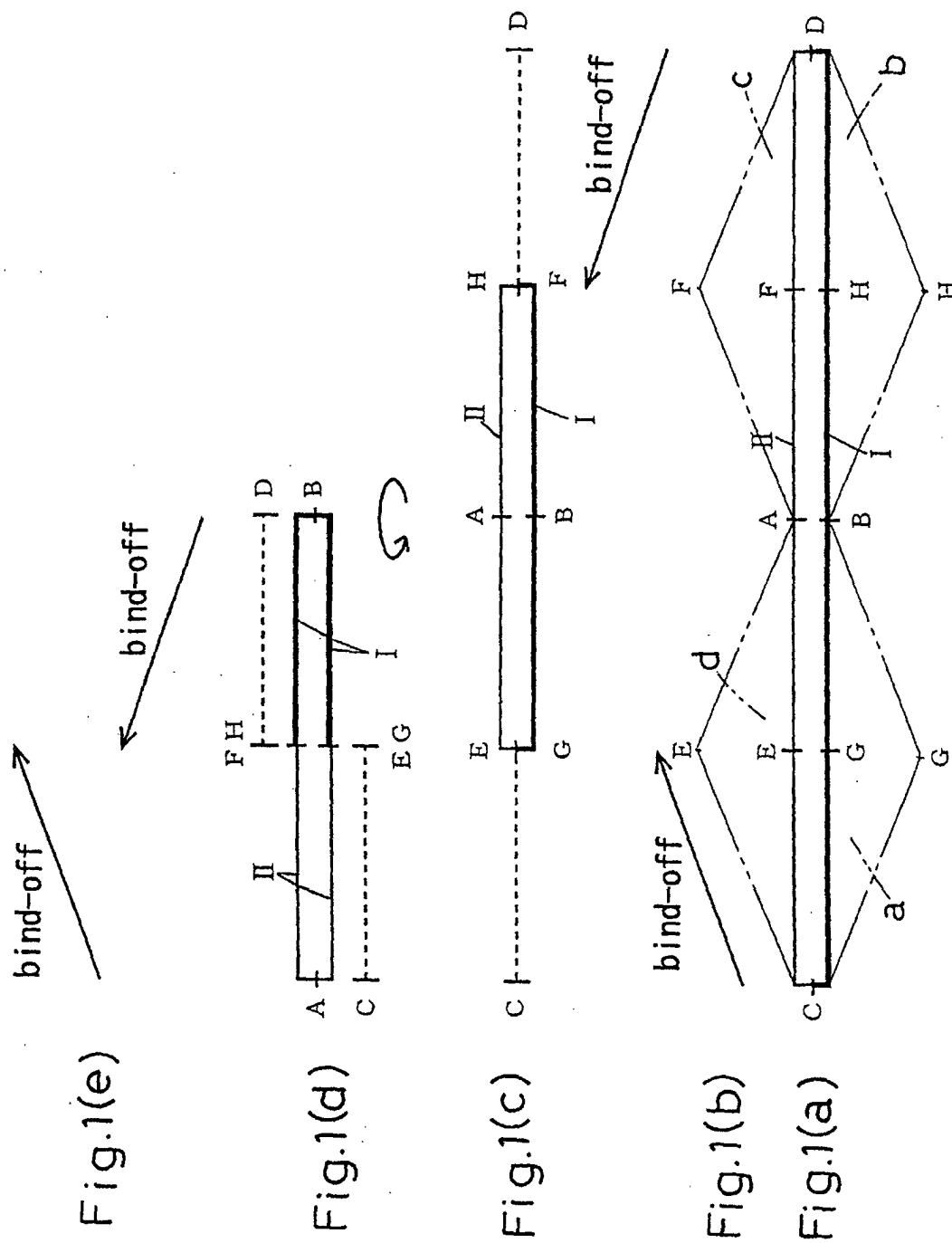
Claims

1. A tubular knitted fabric having a depth formed thereto and joined that is knitted by a flat knitting machine having at least a pair of front and back needle beds each slidably accommodating knitting needles, **characterized in that** the stitches of front and back knitted fabrics are overlapped with each other and bound off in the regions located on both the outermost right and left sides in a knitting width at the terminal end of the tubular knitted fabric in which the front and back knitted fabrics are continuous to each other as well as the stitches of the adjacent regions in the front and back knitted fabrics, in which the stitches of the front and back knitted fabrics are overlapped with each other and bound off between the regions, are overlapped with each other and bound off.
2. A method of knitting a tubular knitted fabric by closing the terminal end of a knitted fabric knitted as the

tubular knitted fabric in which a front knitted fabric is continuous to a back knitted fabric at both the ends thereof by a flat knitting machine having at least a pair of front and back needle beds each slidably accommodating knitting needles, **characterized by** comprising:

a step of dividing the loops of the final course of a tubular knitted fabric held to front and back needle beds into a plurality of regions, overlapping the stitches of front and back knitted fabric that confront in front and back in the regions located on the right and left outmost sides of the divided regions with each other and binding off the overlapped stitches; and
a step of overlapping the stitches of the adjacent regions in the front and back knitted fabrics, in which the stitches of the front and back knitted fabrics are overlapped with each other and bound off between the regions.

3. A method of knitting a tubular knitted fabric according to claim 2, **characterized in that** the second step according to claim 2, which overlaps the stitches of the front and back knitted fabrics with each other and binds off the overlapped stitches, comprises a step repeating knitting for transferring the stitches of the front knitted fabric nearest to the side end thereof from a front needle bed to a back needle bed at one end of the tubular knitted fabric in the knitting width thereof and transferring the stitches of the back knitted fabric nearest to the side end thereof from the back needle bed to the front needle bed at the other end of the tubular knitted fabric so that the respective regions to be joined of the knitted fabrics are shifted to the positions of the front and back needle beds at which the respective regions confront each other, thereafter overlapping the stitches held to the knitting needles of the needle beds that confront each other in front and back, and binding off the overlapped stitches.
4. A method of knitting a tubular knitted fabric according to claim 2, **characterized in that** a knitted portion is formed by flechage knitting by reversing a yarn feed direction in mid course of the knitted region of the tubular knitted fabric and using the knitting needles of a part of the knitted region subsequent to knitting of a tubular shape, and the loops of the final courses of the flechage-knitted portion are coupled with each other.



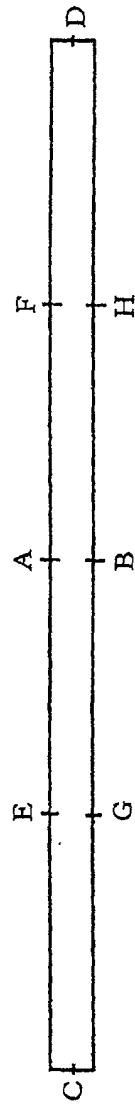


Fig. 2(c)

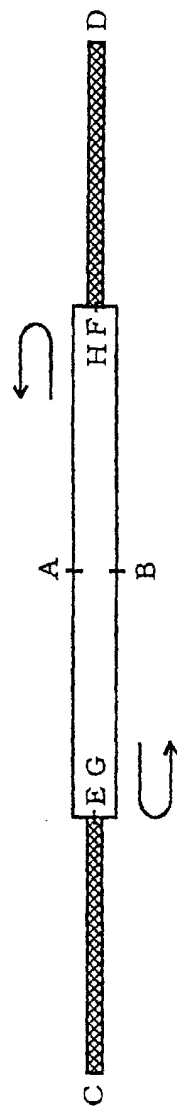


Fig. 2(b)

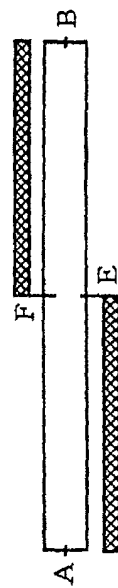
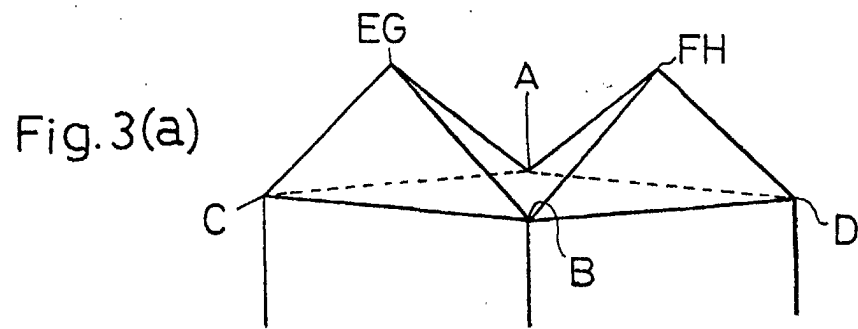
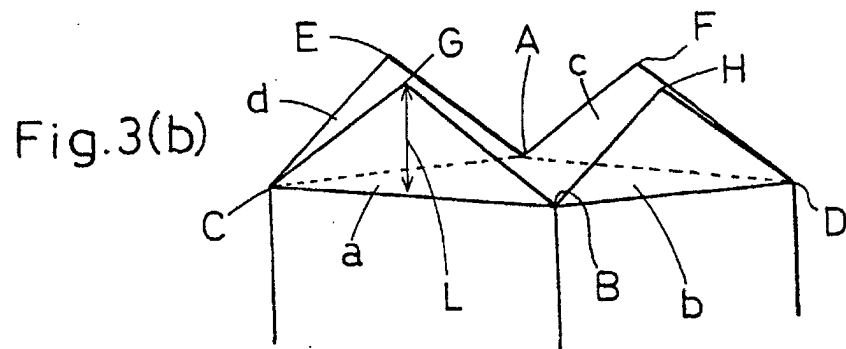


Fig. 2(a)



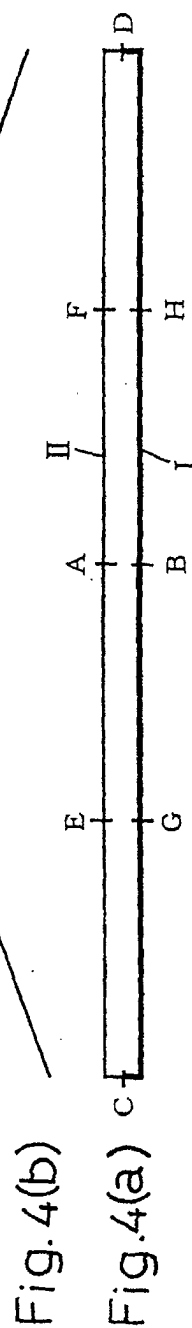
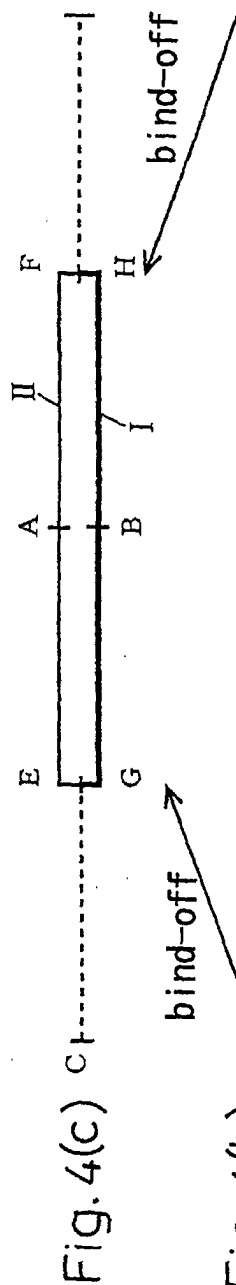
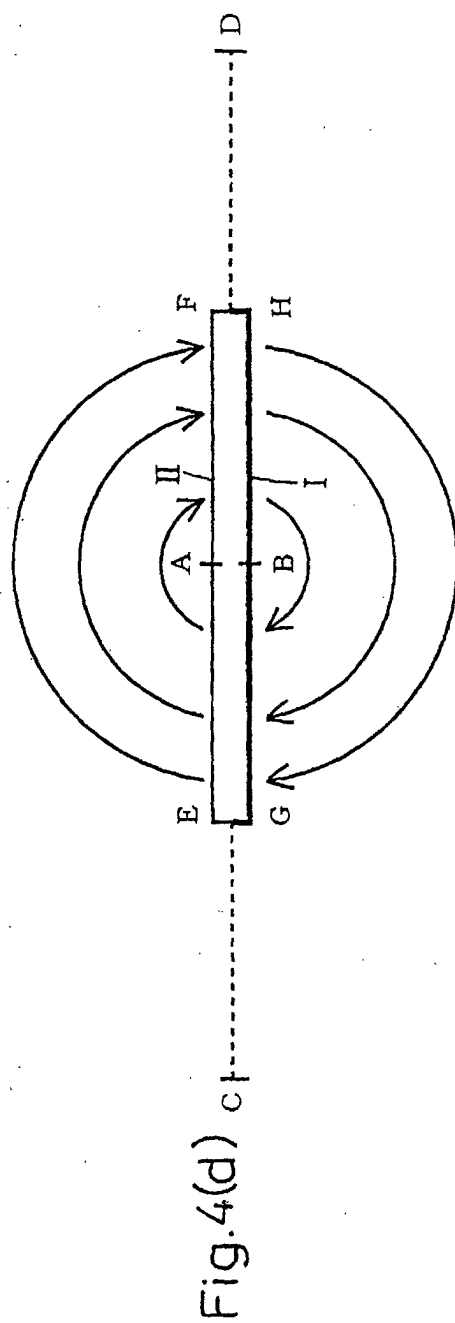


Fig.5

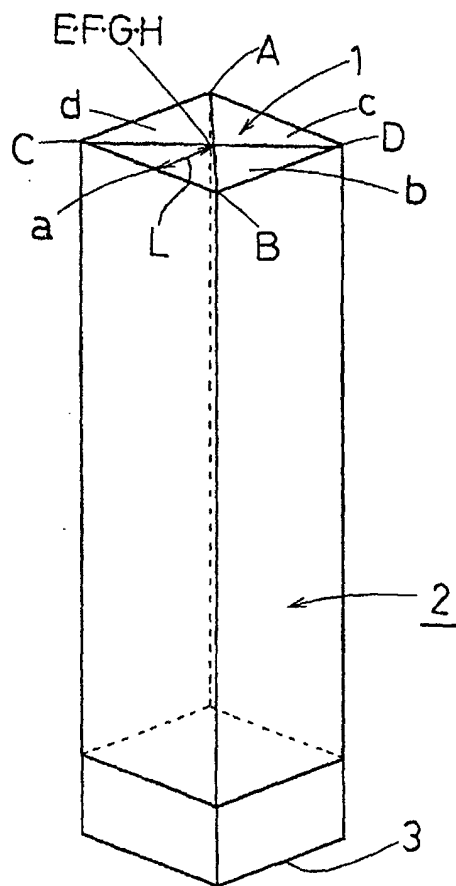
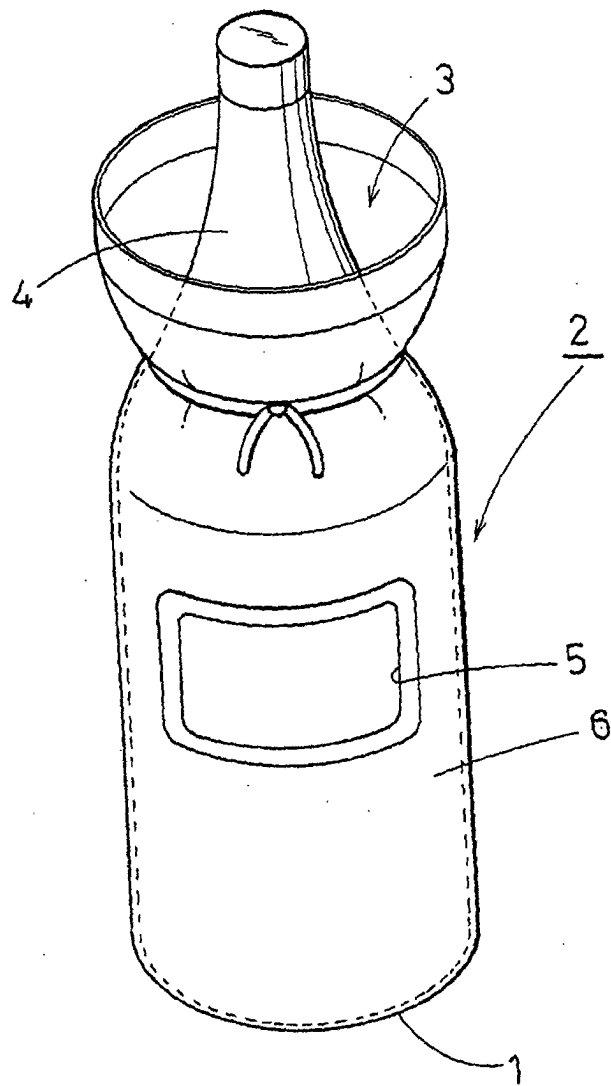


Fig.6



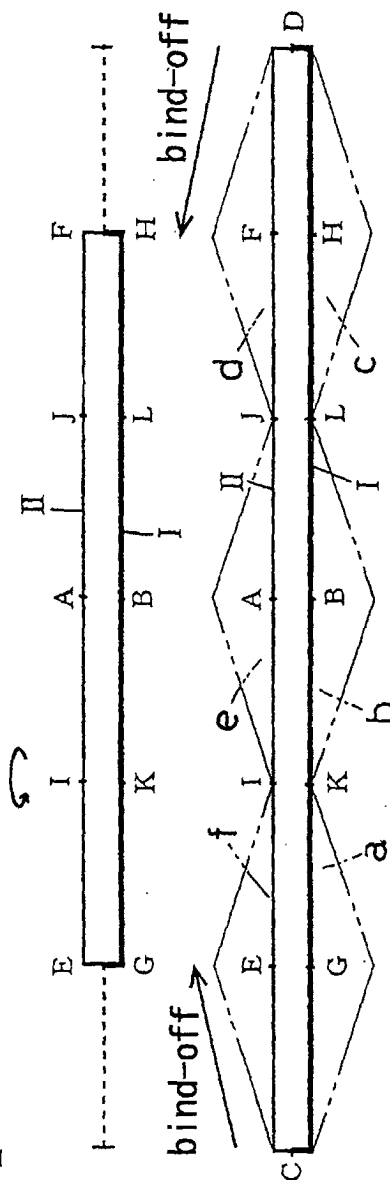
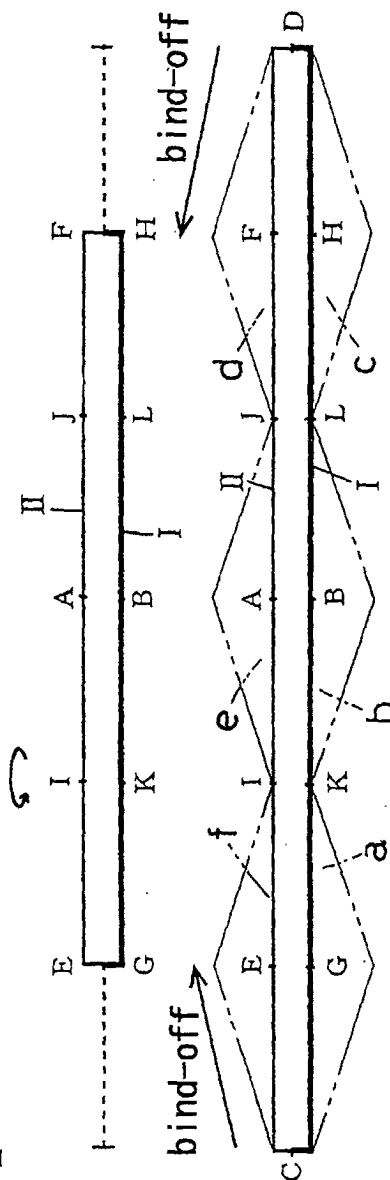
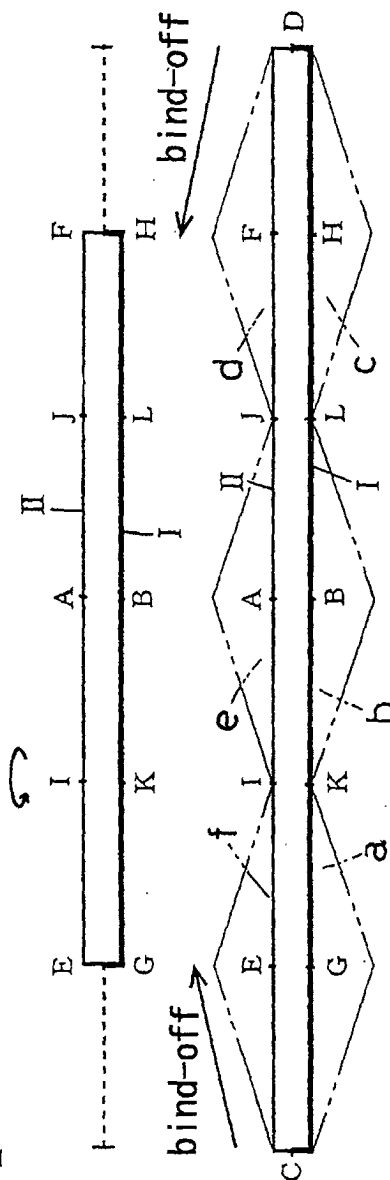
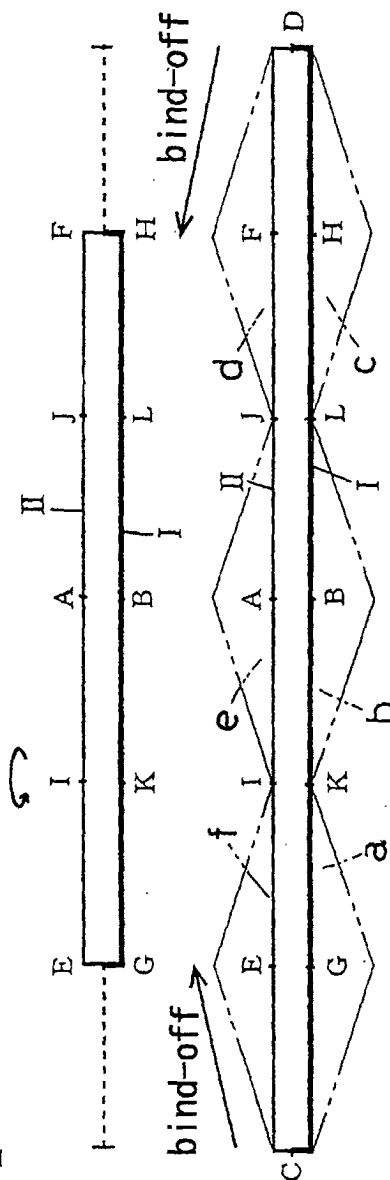
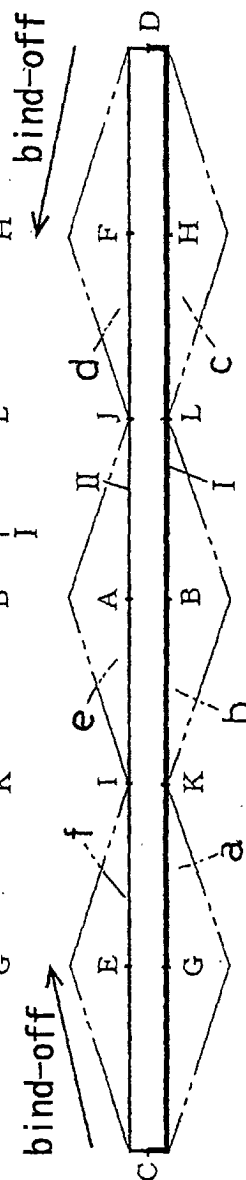
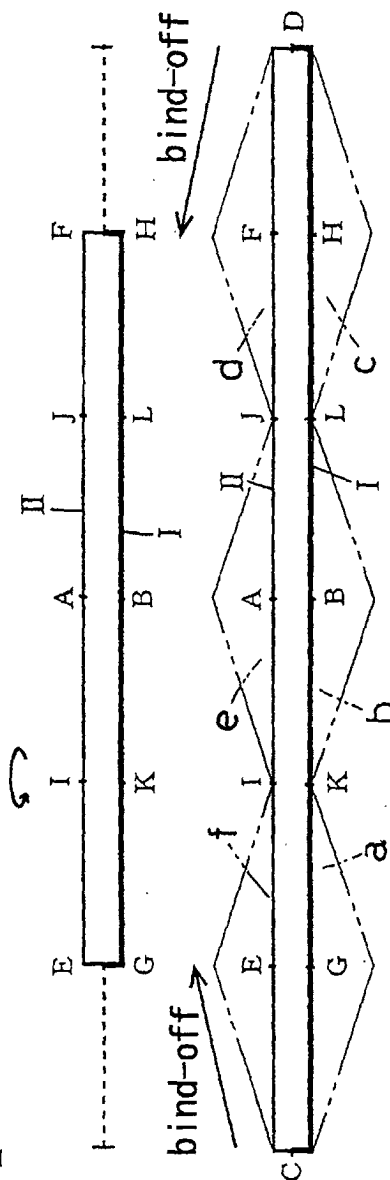
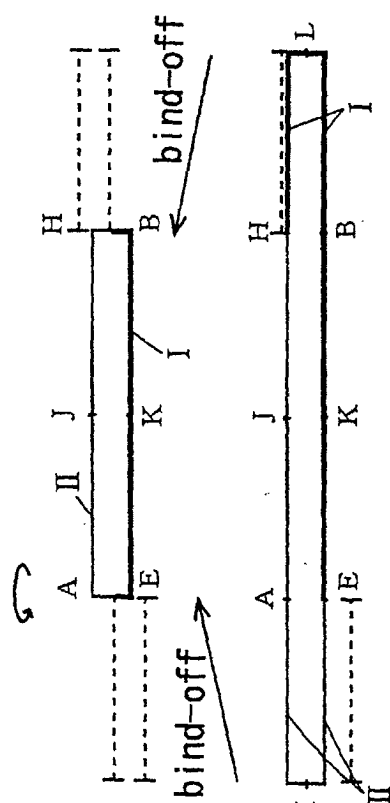
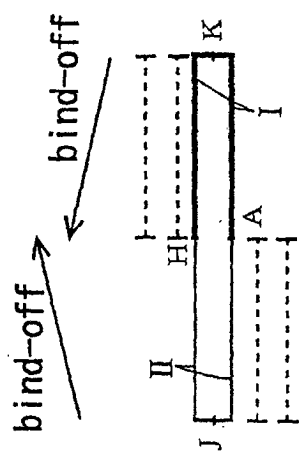
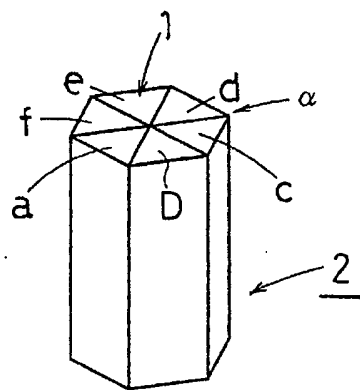
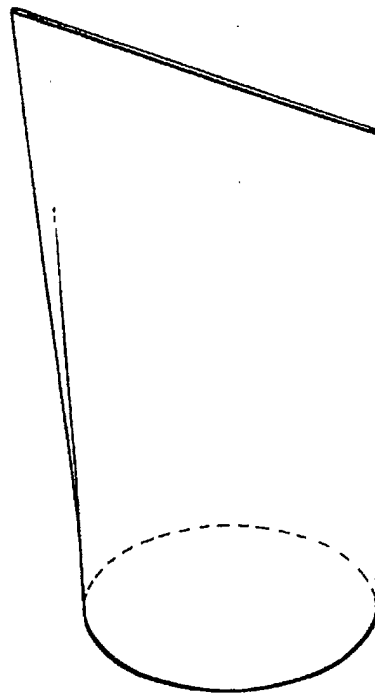


Fig. 8



PRIOR ART

Fig.9



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/04298

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ D04B7/30, 1/22		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) Int.Cl ⁷ D04B7/00-7/34, 1/00-1/28		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1940-1996 Toroku Jitsuyo Shinan Koho 1994-2002 Kokai Jitsuyo Shinan Koho 1971-1995 Jitsuyo Shinan Toroku Koho 1996-2002		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	WO 00/28121 A1 (Shima Seiki Manufacturing Ltd.), 18 May, 2000 (18.05.00), (Family: none)	1 2, 4 3
Y A	JP 3-75656 B2 (Shima Seiki Manufacturing Ltd.), 02 December, 1991 (02.12.91), (Family: none)	2, 4 1, 3
A	JP 7-70886 A (Shima Seiki Manufacturing Ltd.), 14 March, 1995 (14.03.95), (Family: none)	1-4
A	US 6109068 A (H. Stoll GmbH. & Co.), 29 August, 2000 (29.08.00), & JP 11-12903 A & EP 874076 A & DE 19717415 A1 & CN 1199786 A	1-4
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 23 July, 2002 (23.07.02)		Date of mailing of the international search report 06 August, 2002 (06.08.02)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/04298

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5749247 A (General Motors Corp.), 12 May, 1998 (12.05.98), & JP 2750287 B2	1-4
A	JP 61-20667 B2 (Toshiko YOSHIDA), 23 May, 1986 (23.05.86), (Family: none)	1-4
A	US 5836177 A (Shima Seiki Manufacturing Ltd.), 17 November, 1998 (17.11.98), & JP 3044368 B2 & EP 781880 A	1-4
P,A	WO 01/88243 A1 (Shima Seiki Manufacturing Ltd.), 22 November, 2001 (22.11.01), (Family: none)	1-4

Form PCT/ISA/210 (continuation of second sheet) (July 1998)